

SOUTH AFRICA'S CITRUS TRADE FLOWS AMONG THE BRIC

COUNTRIES: BRAZIL, RUSSIA, INDIA AND CHINA

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ABSTRACT

This paper assessed trade potentials of South Africa's citrus exports to the BRIC countries. The gravity model has proven to be one of the greatest stories in empirical economics as a tool analyzing data acquired during 1999 to 2013. Economic and market size encourage volumes of citrus exported while tariffs, exchange rates and long distances have an element of discouraging volumes exported. Introduction of free trade policy among the BRIC countries with zero percent tariffs could increase citrus volumes exported significantly.

KEYWORDS: South Africa's Citrus Exports, Gravity Model, BRIC Countries, Trade

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INTRODUCTION

South Africa (SA) citrus industry has been from the beginning established to be export orientated (DAFF, 2013; Khuele & Darroch, 1997). Over the years it has been successful in grabbing sizeable market share in different market destinations. This sizeable market share has been realized through passing enormous trade limiting factors of different statue. Furthermore this trade limiting factors over the years inspired South Africa's citrus exporters to seek new market destinations with favorable entry requirements while still making good profits. BRIC (Brazil, Russia, India and India) countries have become a market destination of high hopes for South Africa citrus exporters since EU (European Union) countries which have been over the years the market destination of interest threaten SA citrus imports due to the newly introduced sanitary and phytosanitary measures. The fastest growing economy, great potential market destination for exporters and enormous population size of the BRIC countries has emerged to be an exporting market of interest for many countries and that has made South Africa's citrus exporters to set their course in securing a biggest portion of the market (Mizuho Research Institute, 2006). It has become more advantageous for South Africa's citrus to seize as desirable market portion as trade relations are daily strengthen in these countries ever since South Africa had been invited to join and become the member of the BRIC countries to be BRICS (Brazil, Russia, India, China and South Africa). On the other hand, other than the aforementioned factors that encourage or limit the exports of SA citrus, there remains another factor which has played a major role in encouraging trade of fruits in the world of today. An ever increasing habit of eating healthy better known from the developed countries has swept-inn in the people of the developing countries and that has made the consumption of fruits to increase. For example not a long time ago China focused on finding ways to feed a large population with limited recourses, but recently, that focus has shifted to be more on feeding people healthy and safe goods (Maru, 2014; DAFF, 2013). The organization of this paper is as follows: part one is an introduction. Part two consists of the

export trends of SA's citrus to BRIC countries. Part three briefly discuss the gravity model which applied in this paper. Part four is the data description. Part five regression analysis of the results obtained from gravity model. Lastly part six consists of closing remarks

EXPORT TREND OF SA'S CITRUS TO BRIC COUNTRIES

SA exported a total volume of 1498081 tonnes of citrus fruits over the period of 15 years from the year 1999 to the year 2013. One of the years of remarkable note is the year 2013 where a total volume of 159320 tonnes were exported. This large volume of citrus exports which constituted 29.06% of the total exports of all the years mentioned in above sentence of this study was the first ever highest recorded in the BRIC countries since South Africa had joined and participated among the BRIC countries. Even though on average on an annual basis, SA exports large volumes of citrus to some of the BRIC countries, exporters are not yet satisfied. The series of Figures below, source being Own calculations based on data from DAFF depicts the status quo of SA citrus exports to BRIC countries for the period of 15 years, from year 1999 to year 2013. As depicted in Figure 1 on average, oranges are the most exported citrus variety and Russia is the most importing country among the other countries followed by China, India and lastly Brazil. Figure 1 vividly shows Orange exports experienced some good years of exports until 2013 there had been a gradually increase in volumes exported. However, there were exceptions in some years for instance 1999 to 2001 where there were fewer exports of oranges from Brazil, India and China. The primary cause of such fewer exports may have been due to less quantity of citrus exported, owing to floods, which affected the quality and the size of the crop while on the other hand may have been high tariffs, and non-tariffs measures.

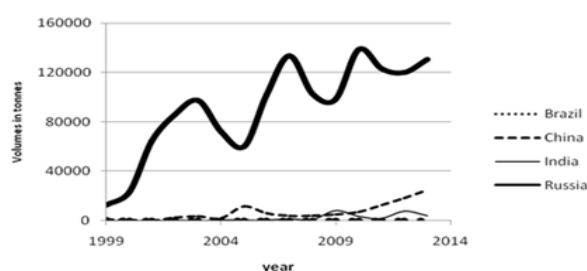


Figure 1: Export Volumes of Oranges from 1999 To 2013

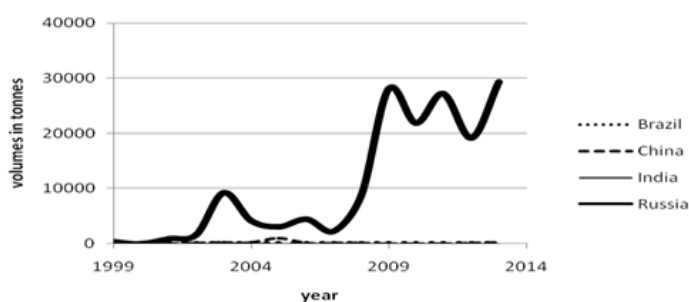


Figure 2: Export Volumes of Lemons from 1999 To 2013

As presented in figure 2, over the period of 15 years, volumes of lemons exported to BRIC countries by SA varied in some years exporting more and in some years exporting less even to the extent of no record of exports in other years especially Brazil.

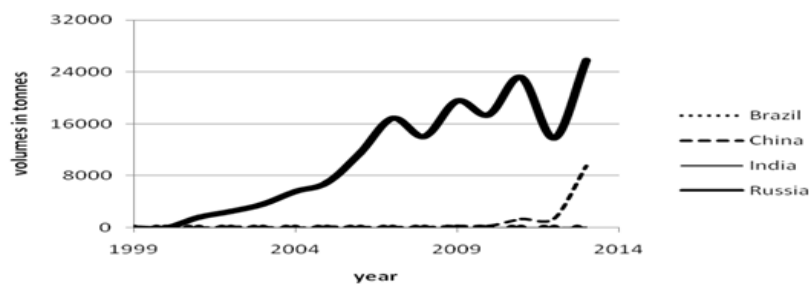


Figure 3: Export Volumes of Grapefruit from 1999 To 2013

As for grapefruit there have been various reasons for fewer volumes exported to BRIC countries, to mention just a few, China is among the leading world producers of grape fruit and also leading in consumption of the same fruit. On the other hand tariffs and minimum standards in the form of non tariff measures to access the BRIC market are considered to be a steep hill to climb by exporters. One other reason for fewer volumes of export to BRIC countries, SA grape fruit has more demand in the European market compared to BRIC market. Figure 3 depicts the grapefruit exports to BRIC countries

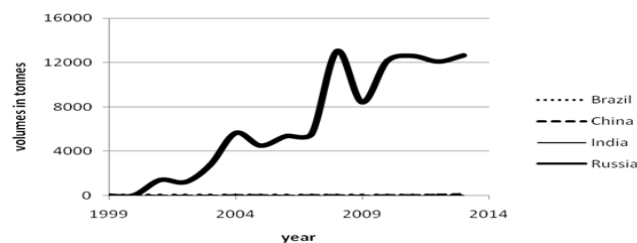


Figure 4: Export Volumes of Mandarins from 1999 To 2013

Mandarins performed poorly compared to other varieties of citrus and such performance can be associated with the large volumes being absorbed by the European market which accounted for more than 70% in all the period that has been presented in this paper. Of course in the least percentage that was acquired by the BRIC market, other various reasons contributed for mandarins to become the least exported compared to the other citrus cultivars which SA exported to this market. Among other reasons that contributed to fewer volumes exported, to mention only a few and most significant for this paper, food safety standards and tariffs standing in the China market, same region with Brazil and India. According to SA citrus exporters, some countries in the BRIC countries are promising for SA citrus due to huge population and booming economy but the requirements that have to be met before accessing this market are astronomers. Figure 4 depicts the mandarins trade flows to BRIC countries.

THE GRAVITY MODEL

The model was introduced by Sir Isaac Newton and it applies Newton's universal law of gravitation in physics, which states that every object in the universe attracts other object and is proportional with a force that is directly proportional to the product of masses and inversely proportional to square of their distance between their centers. The basic form of the gravity equation is as follows:

$$F_{ij} = G (M_i^{\beta_1} M_j^{\beta_2} / D_{ij}^{\beta_3}) \epsilon_i \quad (1)$$

Where: F_{ij} is the gravitational attraction, G is the gravitational constant, M_i , M_j are the mass of two objects and D_{ij} is the distance.

Tinbergen was the first economist to put gravity model into application in international trade even though it had been long used in social sciences (Tinbergen, 1962) and secondly followed by (Pöynönen, 1963). Gravity model has proven to be one of the greatest stories in empirical economics to date and it has been consistent with several theoretical models of trade (Feenstra et al., 2001). In 1966 by the hand of Linnemann, gravity model has been said to be a span of oxen for applied work in international trade. According to Kristjánsdóttir (2008) gravity model has been an effective tool in explaining bilateral trade flows by clearly explaining the factors that aid or restrict trade among trading countries.

Bergstrand (1985) and Buch et al. (2004) had said that gravity model that it has been long recognized for its consistent empirical success in explaining many streams of movement, such as migration, commuting, tourism and commodity shipping. Regardless of some misunderstanding about the model's trade-theoretical foundation, it has surprisingly proven itself to be robust in empirical relationship which prevailed in spite of changing focus in trade theory (Melchior et al., 2009). The basic form of the gravity equation is presented as follows:

$$\ln(F_{ij}) = \alpha + \beta_i * \ln(GDP_i) + \beta_j * \ln(GDP_j) + \gamma * \ln(D_{ij}) \quad (2)$$

F_{ij} can be exports from country i to country j , or total trade (exports + imports) between the two countries but that depends on the model specifications. In the case of the afore mentioned basic form of gravity model I use subscript i for the exporter and j for the importer. The impact of exporting and importing country size is measured by β parameters, and distance is measured by γ .

Different theoretical approaches allow gravity model to be rationalized in different spheres. For example, the total supply and demand of the exported or imported product tend to increase with country size. Another potential explanation of gravity model is due to the comparative advantage which size of the country also affects as proposed in the new trade theory (Melchior et al., 2009). The location of the market destination adds another important feature since GDP levels may depend on geographic economic placement and distance. Therefore a step worth to be incorporated in developing theoretical approach to gravity model is the one mentioned in the previous sentence which to date has done only to a limited extent.

GDP estimates are usually symmetrical; equal size, positive and normally somewhat below one especially when the gravity equation is used for exports plus imports. On the sector level, gravity model if applied for studying trade may have estimates of GDP that are different β_i and β_j .

Distance parameter as a proxy for various trade costs variables normally has negative estimates though the absolute value of the distance parameter could be reduced. In essence, the distance parameter could be of no significance if it was possible to measure all factors that influence trade correctly. As mentioned before that GDP levels may depend on geographic placement of the market destination, for example countries located centrally have higher GDP levels due to location placement. Therefore GDP may be endogenous and depend indirectly on distance. To counterattack such biasness, a term in the gravity equation that captures location of placement needs to be included (Anderson and Wincoop 2003). But the problem of location placement becomes more important if estimation in the gravity equation is with multilateral data for many countries. In the case of this paper, the data used is for South Africa's citrus exports only to the BRIC countries and the equation changes to:

$$\ln(EXPT_{kjt}) = \alpha + \beta_1 \ln(GDP_{jt}) + \beta_2 \ln(DIST_{jt}) + \beta_3 \ln(POP_{jt}) + \beta_4 \ln(EXCHR_{kjt}) + \beta_5 \ln(Tariff_{kjt}) + \beta_6 \ln(price_{kjt}) + \epsilon_{jt} \quad (3)$$

As mentioned before that in this paper the focus is on South Africa's citrus exports only, therefore the i subscript has been dropped since it will be common in all observations, but subscript k representing citrus has been added since regressions of different products of citrus will be run.

This paper then also added other variables of interest to further explain the objectives of the study. The table below presents the variables that are used in the gravity equation in this paper to measure the factors encouraging or discouraging the quantities/volumes of South African citrus exported to BRIC countries.

Table 1: Variables Used in Regression Model

Variables	Description
Lnexpt	Logarithm of export volumes of citrus product to the BRIC countries in year t
Lngdp	Logarithm of GDP of the BRIC countries expressed by US\$ in the year t
Lnpop	Logarithm of Population in the BRIC countries in year t
Lndist	Logarithm of Distance from South Africa capital city to the capital cities of the BRIC countries
Intariff	Total ad valorem tariffs levied on South African oranges exported to the BRIC countries in year t
Inexchr	Real exchange rate between South Africa and the BRIC countries in year t
Lnprice	The price of the citrus product, unit: usd/ton in the year t among the BRIC countries
ε_{it}	The error term

DATA DESCRIPTION

Data set of this paper contains annual citrus (oranges, lemons, grapefruit and mandarins) exports from South Africa to BRIC countries, GDPs, population, total and valorem tariffs levied on South African citrus when exported to the BRIC countries during the year of export, average annual exchange rate, price of citrus product, unit: usd/ton and distance from the capital city of South Africa to the capital cities of the BRIC countries. The construction of the above mentioned data collection is based on the following years 1999 – 2013.

The main sources of data used in this paper are the following:

- Citrus exports are taken from department of agriculture, fisheries and forestry (DAFF) South Africa and Easy Data by Quantec South Africa.
- BRIC countries data, GDPs and Population are taken from the World Bank's WDI (World Development Indicators), online version 2014.
- Data on geographical distance are constructed from coordinates taken and from the Global Cities database.
- Tariff data are taken from UNCTAD's TRAINS database and also using WITS.
- Exchange rates data are own calculations and are obtained following the following steps: The nominal exchange rate is calculated as the annual average of the national currency unit of South Africa per US dollar. Data of exchange rate for both trade partners were obtained from the World Bank.
- Data for prices are own calculations from the annual citrus exports divided by annual amount of money made and the price unit is usd/ton in the year to the BRIC countries

REGRESSION RESULTS AND DISCUSSIONS

The results presented in the following tables consist of four different citrus cultivars namely, oranges, lemons, mandarins and grapefruit. As mentioned in the abstract that this paper seeks to understand the trade potentials of South

Africa's citrus exports to the BRIC countries by identifying and analyzing significant factors that are encouraging or discouraging the quantities/volumes of citrus exported based on a gravity model and time series data from 1999 to 2013. Results presented in the orange exports regression table includes all the BRIC countries while the other three regression tables presenting, lemons, mandarins and grapefruit do not include all the countries, Brazil is excluded due to no records of exports.

Orange Exports Analysis

For oranges since there is data records for all the four BRIC countries this study decided to follow the fixed effect method suggested by Cheng and Wall (2005) to get a clear picture of the export status. Furthermore among all the citrus cultivars being exported to BRIC countries, oranges are the most important cultivar for SA citrus exports, therefore getting a clear picture is of paramount importance. Table 1 presents Regression results for orange exports from South Africa to other BRIC countries.

The determinants of the exports of oranges from SA to BRIC countries are economic size, market size and distance between the two countries, tariffs expressed in ad-valorem tariffs, the real exchange rate volatility and the estimated coefficients seem to have expected signs. The 1 percent increase in the GDP and population of the BRIC countries tends to be associated with a 0.68 and 4.2 percent increase in the volumes of oranges being exported by South Africa respectively and these estimates are statistically significant. Also, for each 1 percent increase in tariffs levied on SA oranges when exported to BRIC countries tends to be associated with a fall of 16.2 percent volumes being exported. The previous sentence is in line with a couple of studies that have been conducted on trade limiting factors such a tariffs where it has been discovered that tariffs have significant negative impact on agricultural trade. For example a study on "Estimating the Constraints to Agricultural Trade of Developing Countries" conducted by Moïsé et al. (2013) found out that a reduction by 10 percent in the tariff trade restrictiveness have a potential, on average, to a 3.7 percent increase in agricultural exports. Real exchange rate volatility and price \$US/ton in the year of export from SA to the BRIC countries are statistically insignificant and are omitted in the reported results. Among the BRIC countries, Russia seems to be the country most encouraging SA orange exports.

Table 2: Regression Results for Orange Exports from South Africa to other BRIC Countries

Variables	Definition	Coef.	T-Value	P> T
ln_gdp_usd	Logarithm of GDP	0.6761**	2.17	0.036
lnpop	Logarithm of population	4.1782***	4.70	0.000
tariff_OR	Tariffs of oranges	-0.1618***	-2.69	0.010
lnexchr	Logarithm of exchange rate	--	--	--
lnprice	Logarithm of price	--	--	--
_lcountry_1	Brazil	Based country		
_lcountry_2	China	-10.3712***	-7.19	0.000
_lcountry_3	India	--	--	--
_lcountry_4	Russia	9.1537***	13.12	0.000
_cons	Constant	-86.7537	-6.37	0.000
Number of Obs = 48 Prob > F = 0.0000 R-Squared = 0.9378 Adj R-Squared = 0.9304				
Significance Levels Indicated By *** (P Value<0.01), ** (0.01<P Value<0.05) And * (0.05<P value<0.10)				

Lemon Exports Analysis

As mentioned before, table 2 below of regression results for lemons do not include all the BRIC countries; Brazil

is excluded due to no records of exports from SA. One of the reasons of no export records for lemons from SA might be caused by the same season calendar for lemons as both countries are from the southern hemisphere. In the same vein of the two countries being from the southern hemisphere, Brazil is among the top 2 countries in the region with highest lemon production and more than four times better than South Africa in production capacity.

In the three remaining analyzed countries, China, India and Russia, all most estimated coefficients had expected signs and are statistically significant except population size which is statistically insignificant and has been omitted in the presented results. One of the reasons for population size to be statistically insignificant might be due to a missing variable in the used equation, and that requires a further research beyond this paper. The 1 percent increase in the GDP of the three analyzed countries tends to be associated with a 0.9 percent increase in the volumes of lemons being exported by South Africa and the estimate is highly significant statistically at the $P\text{-value} < 0.01$. On the other hand for each 1 percent increase in tariffs levied on SA lemons when exported tend to be associated with a fall of 22.6 percent. There is hope for SA lemons in the future among BRIC countries as these countries might introduce preferential trade agreements. The real exchange rate is significant correlation with trade variation indicating that price competitiveness is important for South Africa's lemon exports, when South African currency appreciates with a percent tends to be associated with 2 percent fall of volumes being exported. The distance as proxy for transportation costs has an element of discouraging the desired large volumes of exports by SA lemon exporters at 12.4 percent.

Table 3: Regression Results for Lemons from South Africa to other BRIC Countries

Variables	Definition	Coef.	T-Value	P> T
lngdp_usd	Logarithm of GDP	0.8986***	2.72	0.011
lnpop	Logarithm of population	--	--	--
lnDIST	Logarithm of distance	-12.4061	-1.53	0.139
lnprice_le	Logarithm of price	-2.4411***	-5.43	0.000
lnTARIFFS_le	Logarithm of tariffs	-22.6483**	-2.26	0.032
lnEXCH	Logarithm of exchange rate	-2.0650	-1.64	0.113
_cons	Constant	101.927	1.41	0.171
Number of Obs = 32 Prob > F = 0.0000 R-Squared = 0.8714 Adj-R-Squared = 0.8467				
Significance Levels Indicated By *** (P Value<0.01), ** (0.01<P Value<0.05) And * (0.05<P value<0.10)				

Mandarins' Exports Analysis

In the same manner as lemon regression analysis, mandarins analysis in table 3 below does not include all the BRIC countries; Brazil was again excluded due to no records of exports from SA. In the same vein of no records of mandarins exports from SA, one of the reasons might be caused by the same season calendar as both countries are from the southern hemisphere. Furthermore as the two countries are from same region, Brazil is among the top countries with highest soft citrus production and more than 10 times better than South Africa in production capacity.

The three remaining analyzed countries, China, India and Russia, there are similarities with the analysis of lemons. Similarly with lemons, mandarins, all most all the estimated coefficients have expected signs and are statistically significant except population size which is statistically insignificant and has been omitted in the presented results. One of the reasons for population size to be statistically insignificant might be due to a missing variable in the used equation, and that requires a further research beyond this paper in the same manner analyzed in lemon export regression. Also tariffs levied on SA mandarins when exported over the studied period from SA to the three analyzed countries are statistically

insignificant and are omitted in the reported results. The 1 percent increase in the GDP of the three analyzed countries tends to be associated with a 2.8 percent increase in the volumes of mandarins being exported by South Africa and the estimate is highly significant statistically at the $P\text{-value} < 0.00$. The real exchange rate is significant correlation with trade variation indicating that price competitiveness is important for South Africa's lemon exports, when South African currency appreciates with a percent tends to be associated with 3.1 percent fall of volumes being exported. The distance as proxy for transportation costs has an element of discouraging the desired large volumes of exports by SA mandarins' exporters at 4.4 percent.

Table 4: Regression Results for Mandarins from South Africa to other BRIC Countries

Variables	Definition	Coef.	T-Value	P> T
lngdp_usd	Logarithm of GDP	2.7595***	8.97	0.000
lnpop	Logarithm of population	--	--	--
lnDIST	Logarithm of distance	-4.3976***	-8.00	0.000
lnexchr	Logarithm of exchange rate	-3.1450**	-2.91	0.008
lnprice_ma	Logarithm of price	-2.4077***	-14.89	0.000
lnmatrff	Logarithm of tariffs	--	--	--
_cons	Constant	315.4612	7.11	0.000
Number of Obs = 26 Prob > F = 0.0000 R-Squared = 0.9231 Adj-R-Squared = 0.9085				
Significance Levels Indicated By *** ($P\text{ Value} < 0.01$), ** ($0.01 < P\text{ Value} < 0.05$) And * ($0.05 < P\text{ value} < 0.10$)				

Grapefruit Exports Analysis

Following the same route as lemons and mandarins, grapefruit analysis in table 4 below, does not include all the BRIC countries; Brazil is not included because there are no records of exports from SA. Just like the above analyzed citrus cultivars, one of the reasons of no export records for grapefruit from SA might be caused by the same season calendar for grapefruit as both countries are from the southern hemisphere. Even though in this citrus cultivar, South Africa has more production capacity compared to Brazil, still Brazil might be having a comparative advantage or other market destinations provide better prices for South African grapefruit compared to Brazil.

Turning to the three remaining analyzed countries, China, India and Russia, some of the estimated coefficients rather show unexpected signs and are statistically significant while other estimates are not significant and are omitted in the presented results. The 1 percent increase in the GDP of the three analyzed countries tends to be associated with a 2 percent increase in the volumes of grapefruit being exported by South Africa and the estimate is statistically significant at the $P\text{-value} < 0.02$. On the other hand for each 1 percent increase in tariffs levied on SA grapefruit when exported tend to be associated with a fall of 5.7 percent. As mentioned in the analysis of lemons, even for grapefruit there remains hope for SA in the future among BRIC countries as these countries might introduce preferential trade agreements. Real exchange rate volatility and price \$US/ton in the year of export from SA to the BRIC countries are statistically insignificant and are omitted in the reported results. The distance as proxy for transportation costs for some strange reasons has an element of encouraging trade at 6.6 percent and that might be due to an unaccounted variable in the equation used in this paper.

Table 5: Regression Results for Grapefruit from South Africa to other BRIC Countries

Lnexptgf	Definition	Coef.	T-Value	P>T
lngdp_usd	Logarithm of GDP	2.0232**	2.33	0.027
lnpop	Logarithm of population	-3.61e-09**	-3.09	0.004

Table 5: Contd.,				
Lndist	Logarithm of distance	6.5760*	1.84	0.077
Lntariff_gf	Logarithm of tariffs	-5.6551**	-3.49	0.002
Lnexchr	Logarithm of exchange rate	--	--	--
lnprice_ma	Logarithm of price	--	--	--
_cons	Constant	-103.2316	-2.00	0.055
Number of Obs = 34 Prob > F = 0.0010 R-Squared = 0.4611 Adj R-Squared= 0.3868				
Significance Levels Indicated By *** (P Value<0.01), ** (0.01<P Value<0.05) And * (0.05<Pvalue<0.10)				

CONCLUSIONS REMARKS

This paper has shown that in the current SA citrus exports status to the BRIC countries, there are quite number of factors which discourage trade than factors which aid or encourage trade. In almost all the cultivars of citrus exported to the BRIC countries by SA over the studied period, the estimates of tariffs are highly significant in showing export volumes being reduced. Not only tariffs are the main challenging factor in discouraging large volumes of exports, the real exchange rate vitality also has been proven to possess an element of discouraging trade flows, its (exchange rate) estimates have shown to be significant in reducing the desired volumes to be exported by SA citrus exporters. On the other hand, the analysis has shown that economic size and population as expected among the BRIC countries encourage the SA citrus exports.

Other factors of importance in determining trade potentials of South Africa's citrus exports to the BRIC countries are not captured in this paper such as non tariff measures applied by these countries, economies of scale, the effects of seasonal calendar for example in the case of Brazil as is in the south hemisphere therefore the citrus calendar is the same as South Africa one and that has a potential of discouraging exports from SA to Brazil. The above mentioned argument constitutes an interesting issue for future research.

Furthermore, the study has been made within a certain period of time and most of that time BRICS association was not yet formed therefore more work could be done in the future as more developments in improving trade among the BRIC countries take place. In spite of the aforementioned shortcomings the estimates presented in this paper can provide a useful tool for assessing the potential gains from trade agreements.

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